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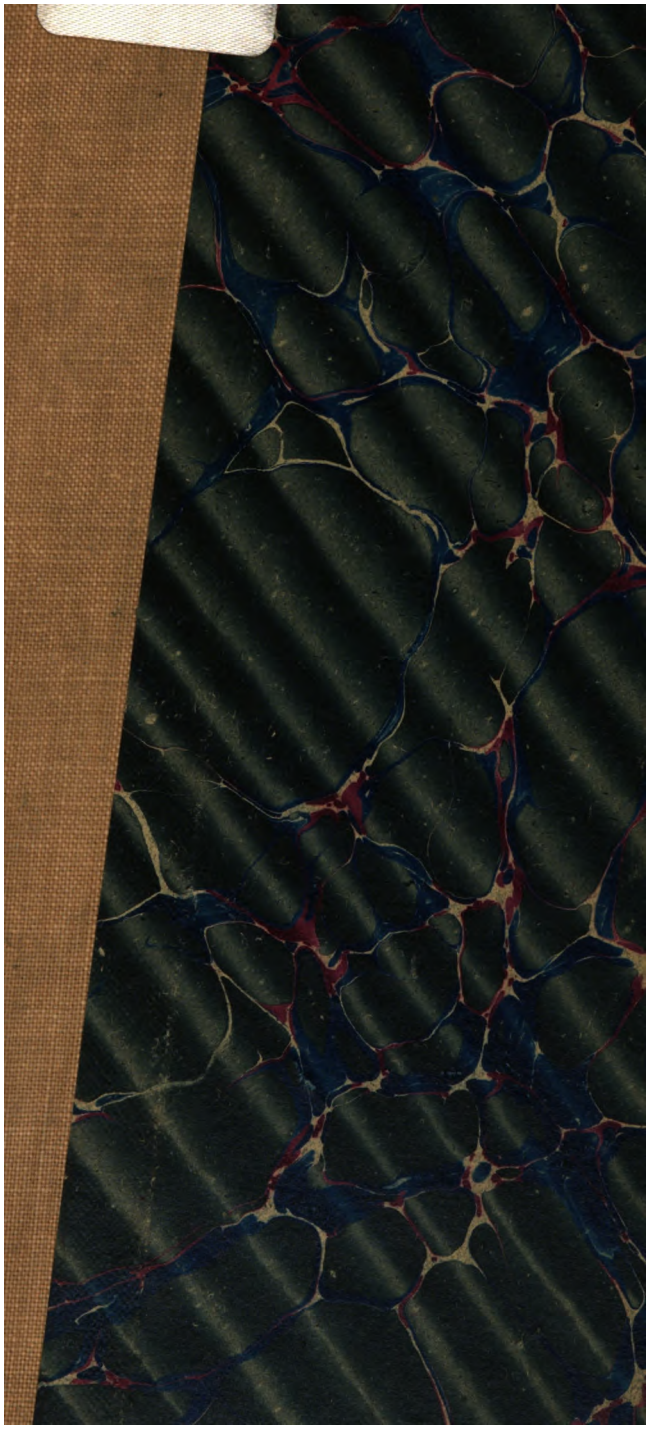

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NEW CARBONIFEROUS INSECTS.

[*Extracted from the* GEOLOGICAL MAGAZINE, July, 1881.]

TRÜBNER & Co., 57 and 59, Ludgate Hill, London.

Dr. Hag...

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The Authors figure, copied by himself

I send a new tracing which
shows the missing vein S.H.

Boötia punctinota (tracing) S.H.

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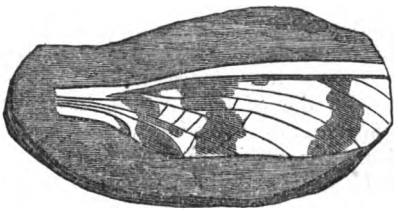
[*Extracted from the* Geological Magazine, Decade II. Vol. VIII. No. 7, p. 293, July, 1881.]

Two New British Carboniferous Insects, with Remarks on those already known.

By Samuel H. Scudder, Esq.

Assistant-Librarian, Harvard College Library, Cambridge, Mass., U.S.A.

By the kind communication of my friend, the Rev. P. B. Brodie, M.A., F.G.S., I have been able to study two very striking wing-fragments from the Coal-measures of Great Britain, which are interesting, not only from the excessive rarity of such remains in this country, but also from their relationship to the two or three already known.



Wing of *Brodia priscotincta*, Scudder. Coal-measures, Dudley Coal-field, Staffordshire.

The first, which I call *Brodia*, in honour of the distinguished writer on the Insects of the Secondary rocks of England, is an ancient form of *Planipennia* or true *Neuroptera*, the structure of whose wings does not agree with that of any of the existing families of the group, but rather shows a combination of features which now distinguish separate families. It has the general aspect of a gigantic *Panorpa*, borrowed from its form, its markings, the presence of a few scattered cross-veins, and the course of the mediastinal nervure. When, however, its neuration is carefully observed, the scapular vein is seen to be fundamentally different, though its position and the origin of its main branch is similar; for, while in both cases the area it occupies is important, in the *Panorpina* the main branch divides dichotomously throughout, and its

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offshoots take a longitudinal direction; while in *Brodia* the main branch emits oblique shoots at regular intervals downward and outward, as it does in other *Planipennia*, but not in *Panorpina*; the veins below the scapular are also very different from what they are in *Panorpina*, and relatively to the rest of the wing much less important.

With the *Hemerobina*, the wide space between whose marginal and mediastinal veins is filled with numerous oblique and generally forked veinlets, and whose scapular vein has numerous sectors, this ancient type has less to do. In these, the mediastinal vein extends nearly to the tip of the wing, while in *Brodia* it terminates a little beyond the middle. The *Hemerobina*, however, differ from other *Planipennia* in the insignificant part usually played by the externo-median vein, which is frequently almost entirely simple or only forked once in the apical half of its course. This peculiarity is borrowed, though not in a striking degree, by *Brodia*, where this vein is forked once about the middle; but whose branches, widely distant like those of the scapular vein, cover a considerable area.

The more essential features of this ancient wing, however, foreshadow the characteristics of the *Sialina*. In form, while it is not very different, it has none of the arching of the costa almost universal among *Sialina*, and usually accompanied in modern types by a broad space between the marginal and mediastinal veins, not at all displayed by *Brodia*. In the brevity of the mediastinal vein *Brodia* resembles the *Raphidians*, but the neuration of the rest of the wing is completely different, while in the *Sialids* proper the mediastinal vein always continues nearly to the tip of the wing. The course and distribution of the branches of the scapular vein, however, are of greater importance, and in this respect *Brodia* agrees very well with the *Sialina*; again, however, the simplicity of the internomedian vein in *Brodia*, where it consists of only a single undivided ray, is very different from that now found in *Sialids*, where it is always divided and often plays a somewhat important part.

Brodia, then, is a *Planipennian* in a broad sense, refusing to affiliate closely with the restricted families of the present day. Nor does it appear to be intimately related to any Palæozoic insect yet described. It is also peculiar for possessing a very large number of fine cross-veins or wrinkles, besides the stout cross-veins which are scattered here and there over the wing; the latter are, however, confined to dark patches to be mentioned presently; while the former are uniformly distributed over the wing, subequidistant, and always run at right angles to the nervures they connect, even where, by keeping that course, they strike the often obliquely directed, stouter cross-veins.

In the preservation of its colours, *Brodia* is the most striking instance known among Palæozoic insects; the markings are sharply defined, and, to judge from Brongniart's illustrations, more deeply tinted than in *Protophasma Dumasi*, which he has described in this Magazine,[1] and elsewhere. The stone on which the wing of

[1] Geol. Mag. 1879, p. 97, Pl. IV.

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Brodia is preserved is of a dull grey colour, and the hyaline parts of the wing do not differ from it in tint. The margins of the wing, however, are nearly black, while the anterior part of the wing next the scapular vein is dull brown; below this are three broad transverse belts, one in the middle, and the others in the middle of either half of the wing, which, and especially the two outer, are of a distinct, though dull, umber brown; these belts are very irregular in outline, following in many cases the course of the transverse veinlets. All the margins of the wing are armed with fine black spinules, generally set in a double row.

From the excellent preservation of the markings the species may take the name of *Brodia priscotincta*. The wing as preserved is 44 mm. long and 12 mm. broad. The possible length of the complete wing was about 55 mm.

The second specimen is a fragment of the basal part of a wing, which, as it shows the roots of all the principal veins, can be placed with a strong degree of probability in the same general group as some other Palæozoic wings; and yet, as it differs strikingly from all of them in certain features, and from its immense size can be confounded with none, merits distinct mention and a name. The fragment itself must have been known for a long time, though I find nowhere any reference to it; besides the piece sent me by Mr. Brodie, I have casts of its reverse, given me about ten years ago by Mr. Woodward, the original of which is, I believe, in the British Museum.

This fragment is remarkable for representing the largest known insect-wing from the Palæozoic rocks, not excepting the *Acridites formosus* of Goldenberg from Saarbrück, or my *Megathentomum pustulatum* from Illinois. Certainly not more, probably much less, than the fifth of the wing is preserved; but the direction of the veins, their very great robustness, and the extraordinary distance apart of the upper three are clear indications that the spread of wing enjoyed by this insect was not less than ten, and may even have been more than fourteen inches; all the principal veins are a millimètre or more thick, and the cross-veins of the upper two interspaces are tolerably distant, stout, prominent, and generally simple. The marginal vein, forming the front border of the wing, is studded with short oblique spines. The other veins lie at very different levels on the stone, and, below the interspaces mentioned, seem rather closely crowded, and are much more curved, sweeping downward, while the upper veins show little tendency to turn from a longitudinal course. All the principal veins are present, and from their trend and relative level, and from the width and nature of the interspaces, there can be no question that the insect belongs to the same group with the *Corydalis Brongniarti* of Mantell, and the *Lithomantis carbonarius* of Woodward, and is, indeed, only to be separated generically from them.

For this gigantic insect the name of *Archæoptilus ingens* is proposed. The length of the fragment is 43 mm. and its width 32 mm.

This naturally leads to an inquiry into the proper zoological

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position of *Lithomantis carbonarius* and *Corydalis Brongniarti*, the "marked similarity" of which Mr. Woodward himself points out, figuring them side by side in describing the former.

Mr. Woodward is assuredly mistaken in referring *Lithomantis* to "the neighbourhood of the *Mantidæ*," notwithstanding that he supports himself by the adherence to his views of such able entomologists as Messrs. Westwood, Waterhouse and M'Lachlan, who can hardly have made a serious study of the neuration. It bears indeed a vague resemblance to that of the *Mantidæ*, excepting in the hind wings, where the fullness of the anal area, with its special development of folding rays in the insect of to-day, need not be looked for in its less specalized ancestor; but when the elements of the neuration are examined, the resemblance is seen to be purely superficial. Then it appears that *Lithomantis* agrees with other ancient types, and not at all with the *Mantidæ*. The front wing of the *Mantidæ* has a very peculiar and characteristic neuration. The marginal vein forms the front border of the wing, as I believe it never does in any saltatorial *Orthoptera*, and always does in the *Neuroptera*. The mediastinal vein is simple, and runs in close proximity to the scapular, terminating near the tip of the wing. So far there is nothing essentially different from the condition of things in *Lithomantis;* but in the next three veins all is different. To use the specific example (*Blepharis domina* of Africa) given by Mr. Woodward: the scapular vein is perfectly simple as far as the extreme tip, when it divides into three very short nervules supporting the apical margin. In *Lithomantis*, however, it emits a stout inferior branch near the middle of the wing, which runs parallel or nearly parallel to the main vein, and probably (if it is like its allies of the time) sends off several branches to the lower apical margin. As this is one of the principal veins of the wing, differences which occur here are significant, and there is hardly any group of insects which has so unimportant a scapular vein as the *Mantidæ*. The differences are even more striking in the next two veins, better preserved in the fossil. In *Blepharis* (and it is much the same in all *Mantidæ*) the externomedian vein is divided at base into two main stems, the upper of which runs in close proximity to the scapular, and in the outer half of the wing sends downward three or four conspicuous oblique veins, which appear at first glance precisely as if they were offshoots of the scapular, which they are not at all; they only perform the office of such offshoots in other wings; the lower branch takes an irregularly longitudinal course below the upper branch, and emits similar veinlets to the lower margin; and the entire area occupied by the two branches of this vein and their offshoots covers very much the larger part of the wing. The internomedian vein, on the contrary, is exceedingly simple, being forked only once (often, in other *Mantidæ*, not at all), and occupies much less space than even the anal area. Now in *Lithomantis* the case is very different; the externomedian vein does not divide at all until near the middle, and then only once or twice, its branches covering an area which is certainly much less than a quarter part of the wing,

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while the internomedian vein subdivides numerously, no less than eight final nervures reaching the margin and covering an area, certainly as great as, and apparently considerably greater than, that of the externomedian vein. These singular differences between the *Mantidæ* and *Lithomantis*, affecting the distribution of the three most important veins of the wing, leave no doubt whatever that the apparent resemblances between the two are only superficial, and that *Lithomantis* can with no propriety be referred to the *Mantidæ*.

What place then should be assigned to *Lithomantis?* I believe we should compare it with certain other Palæozoic wings, and notably with *Corydalis Brongniarti* of Mantell, to which indeed Woodward has himself compared it, giving at the same time an original figure of this interesting fossil.

This insect is especially interesting from its being the first discovered in Palæozoic rocks, and that at a time when, to use the words of Audouin, no fossil insect was known either from the Lower Oolite, the Lias, the Keuper, the Muschelkalk, or the New Red Sandstone; still less in any older rocks. How astonishing then it must have been to find this trace in the Coal! It was at first supposed to be a plant, and as such was sent by Mantell to Brongniart, with other remains from Shropshire. Brongniart placed it in Audouin's hands, and he drew attention to it on several occasions,—before the Entomological Society of France, the Academy of Sciences, and the Assembly of German Naturalists at Bonn, asserting its relationship to *Neuroptera*, where he placed it in the neighbourhood of *Hemerobius, Semblis, Mantispa*, and especially of *Corydalis*. Mantell accordingly figured it in 1839, in his Medals of Creation, under the name of *Corydalis*, adding in the second edition in 1844 the specific name *Brongniarti*. The figure given by Mantell is thoroughly bad, not one of the veins being correctly drawn, and giving an altogether false idea of the wing; that by Murchison, in the various editions of his "Siluria," is apparently made from the same drawing, and therefore almost equally bad; the anal veins alone are more correct.

No further notice appears to have been taken of this wing until, in 1874, Swinton, and again, in 1876, Woodward, gave us new illustrations of it, which leave little to be desired. Swinton thought he had discovered the relics of a stridulating organ at the base of the wing, and compared it to similar characteristics alleged to be present on the under surface of the front wing of the modern *Gryllacris*. He accordingly referred the wing to the *Orthoptera*, and even to the *Locustarian* genus *Gryllacris*. This view cannot possibly be maintained, and a more unfortunate comparison could hardly have been made. Swinton himself acknowledges that he could not succeed in finding a species of *Gryllacris* "with an effective file," and the resemblance of one he figures cannot be ascribed to a stridulating apparatus; for (1) the "file" he figures could not produce any sound when brought into contact with a similar structure on the opposite wing, since from their course the two would not be brought into the proper relations to each other, or at

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least into such relations as they always are brought in stridulating *Orthoptera;* (2) but it could not be brought at all into contact with the similar part of the opposite wing, the wing-insertions being far apart in *Gryllacris,* and the supposed file lying at the extreme base of a vein in the middle of the wing; (3) if this were a stridulating organ, it would not only lie in a different area from where it lies in all other *Locustarians,* but would agree with its place in no other *Orthoptera* whatever.[1]

The supposed file in *Gryllacris* being no stridulating apparatus, any comparisons between it and the fossil from this point of view are of course misplaced; but, aside from this, the position and course of the supposed file of the fossil is entirely different from that of the supposed file in *Gryllacris,* more indeed as it really is in *Locustarians.* But a careful examination of casts of both obverse and reverse, kindly given me by Mr. Woodward, and which show even more details than are given either by Swinton or Woodward (as, for instance, the spiny nature of the edge of the costal margin), brings nothing to light which lends any support to this supposition.

In his comparison of the general neuration of the fossil wing and the modern *Gryllacris,* Mr. Swinton's language is vague, but his conclusion, though evident, is wholly erroneous. It needs only the figures upon his plate to point out the essential differences in the neuration. In the first place, a distinction of prime importance appears in the marginal vein, which forms the border (and is heavily spined) in the fossil, is widely removed from it in *Gryllacris,* the margin being formed of a film supported by superior offshoots from the marginal vein, which of course do not exist in the fossil. In *Gryllacris,* the scapular vein is crowded with a narrow space, embracing on the margin only the extreme tip of the wing; while no such contraction appears in the fossil, where the area embraced by this vein must cover the entire apical margin. The externomedian vein of the fossil is closely crowded against the scapular at base, and parts from it beyond with a sweeping curve (as in most *Neuroptera*), appearing as if a branch of it; while in *Gryllacris* it lies midway between the adjacent veins, and has scarcely the slightest downward tendency, its branches being equally parallel instead of divergent. The internomedian vein in the fossil is widely separated on either hand from the adjoining veins; while in *Gryllacris* it is equally crowded with the others. Finally, all the branches of the latter, as well as those of the preceding vein, impinge upon the apical margin in *Gryllacris;* while in the fossil they strike the lower border of the wing.

These differences, many of which separate also most of the families of *Orthoptera* from those of *Neuroptera,* prove that the fossil

[1] Previous to the receipt of this paper by the Editor, Mr. R. Etheridge, jun., had occasion to examine Mr. Swinton's figured specimen, contained in the British Museum Collection. Mr. Etheridge is convinced that not the slightest trace of any organ, as figured by Mr. Swinton (Geol. Mag. Dec. II. 1874, Vol. I. Plate XIV. Fig. 3, "file"), exists on the specimen in question. The supposed "stridulating organ" is in fact only a fracture of the surface of the nodule, in which the wing is preserved. This is shown both on the fossil and its counterpart.—Edit. Geol. Mag.

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is widely distinct from *Gryllacris*, which, on its side, has a neuration more widely allied to that of *Neuroptera* than, perhaps, any other group of *Neuroptera*; any comparison with other *Orthoptera* would therefore be still more vain, the neuration of the fossil wing bearing so much closer resemblance to that of those groups to which Audouin at first referred it.

Compared even with *Brodia*, it will be seen that the essential features of the neuration are the same, with the single exception of the mediastinal vein, which in *Brodia* ends on the margin not far from the middle of the wing; while in this ancient "*Corydalis*" it extends no doubt nearly or quite to the tip. But exactly such a difference as this is found to-day between *Raphidiidæ* and *Sialidæ*, and there can be little doubt that all four of the wings which have now been discovered (comprising all the important fragments of wings from the English Carboniferous rocks but one—a cockroach) belong to an ancient type of *Planipennian Neuroptera*.

Of these the two which are most nearly related to each other are, unquestionably, the *Corydalis Brongniarti* of Mantell and the *Lithomantis carbonaria* of Woodward. Indeed, the resemblance between them is so close that one would almost consider them as belonging to the same genus. The basal narrowness of the margino-mediastinal interspace, however, as well as the considerably greater importance of the internomedian area in *Lithomantis*, forbid this, though the course and general disposition of every principal vein is nearly identical.

Corydalis Brongniarti, then, being generically distinct from its synchronous allies, and widely different from living types, merits a distinctive name, and may be termed *Lithosialis*, to recall its relationship to the forms to which Audouin first compared it. From *Lithomantis* it differs in the points just mentioned; from *Brodia* in the basal breadth of the margino-mediastinal interspace, the much more numerous branching of all the lower veins, and the greater extent of the mediastinal, besides the more uniform breadth of the whole wing; from *Archæoptilus*, in the proportionally narrow area occupied at the base of the wing by the upper two interspaces, and the far later division of the externomedian vein.

Objection would perhaps be made by some to the retention of Woodward's name of *Lithomantis* for an insect whose supposed resemblance to the *Mantidæ* is found to be erroneous, and which does not even fall within the suborder to which the *Mantidæ* belong; but, aside from the fact that it belonged to an age when the characteristic features of *Orthoptera* and *Neuroptera* were more or less blended, its outward aspect is at first glance by no means very different from the insect to which Woodward has compared it; and the retention of the name has an historic interest which should not be disregarded; the number of Palæozoic insects is not, and is not likely to become, so great as to render the name itself an obstacle to a knowledge and easy recollection of its true affinities.

The following list contains the British Carboniferous hexapod insects discovered up to this time.

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NEUROPTERA.

1. ***Lithosialis Brongniarti*** (supra).

Corydalis (allied to), Audouin, Ann. Soc. Entom. France, vol. ii. pp. vii and viii.
Corydalis Brongniarti, Mantell, Med. Cr. 2nd ed. lign. 124, fig. 2.
Gryllacris (*Corydalis*) *Brongniarti*, Swinton, GEOL. MAG. Dec. II. Vol. I. Pl. XIV. Fig. 3.
Gryllacris (*Corydalis*) *Brongniarti*, Woodward, Quart. Journ. Geol. Soc. Lond. vol. xxxii. pl. ix. fig. 2.

Coalbrook Dale, Shropshire.

2. ***Lithomantis carbonarius***, Woodward, Quart. Journ. Geol. Soc. Lond. vol. xxxii. pl. ix. fig. 1. Scotland.
3. ***Archæoptilus ingens*** (supra), near Chesterfield, between Shelton and Clay Lane. Derbyshire.
4. ***Brodia priscotincta*** (supra). Tipton, Staffordshire.

ORTHOPTERA.

1. ***Etoblattina mantidioides***, Scudder, Pal. Cockroaches, pl. iii. fig. 3.

Blattina sp., Kirkby, GEOL. MAG. Vol. IV. Pl. XVII. Fig. 6.
Blattidium mantidioides, Goldenberg, Fauna Sar. Foss. vol. ii. p. 20.

Claxheugh, Durham. An indeterminate fragment of another wing, perhaps of the same species, is mentioned and figured by Kirkby, in the same place.

2. ***Phasmidæ***, sp. Kirkby, GEOL. MAG. Vol. IV. Pl. XVII. Fig. 8.

COLEOPTERA.

1. ***Curculioides Ansticii***, Buckland, Geology, pl. xlvi. fig. 1. Coalbrook Dale, Shropshire.

The other species described by Buckland as a beetle has been shown by Woodward to be an *Arachnid*.

A more extended paper on the insects discussed here will appear, with a plate, in the Memoirs of the Boston Society of Natural History.

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